Calcarmyobia from the Ethiopian region (Acarina, Myobiidae)*

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Introduction

The author has sought to locate as many species and specimens of bats of the genus *Miniopterus* from the Ethiopian region as possible in the collections of the big museums in the United States and Europe for mites of the genus *Calcarmyobia*. All the four known species of the mites from the region were again recorded in the present study (Uchikawa, 1985*b*), and the five new species or subspecies were also found as described below.

All the specimens dealt with in the present paper will be deposited in the collections of the American Museum of Natural History, New York (AMNH), the British Museum (Natural History), London (BMNH), the Museum National d'Histoire Naturelle, Paris (MNHN), Forschungs-Institut Senkenberg, Frankfurt (SMF) or the US National Museum (USNM), where they were collected.

The scales for Figures are the same to those in Figs 1–6.

As the present paper is the fourth and last report on the mites of the family Myobiidae taken from the bats of the genus *Miniopterus* in the big museums, a summary of the mites themselves and, adopting them as indicators, problems in host systematics will be made in discussion.

Calcarmyobia comoresensis Uchikawa

Calcarmyobia comoresensis Uchikawa, 1982, *Annot. zool. Japan.*, **55:** 39.

Calcarmyobia comoresensis Uchikawa was originally described as a parasite of *Miniopterus manavi* from the Comores Islands (Uchikawa, 1982). It is shown in the present study that the mite is also found in Madagascar. The type of *M. manavi* (BMNH 97.9.1.37) also yielded a female of this species. The anonymous mites in Uchikawa (1982) were identified as *C. comoresensis* in the present study.

MATERIAL EXAMINED. One ♂ and 1♀ (1984.6.12.128–129) ex *Miniopterus majori*, Vobima, Madagascar (BMNH 0.5.5.48); 1♀ (1984.6.12.130) ex *M. majori*, Bersroha, Madagascar (BMNH 32.7.19.1–2); ♂1♀ (1984.6.12.132–133) ex *M. scotinus*, Imasindrory, Madagascar (BMNH 97.9.1.41–3; 1♀ (1984.6.12.131) ex *M. manavi*, Imasindrory, Madagascar (BMHN 97.9.1.37, type); 1♀ ex *Miniopterus*, Tananarive, Tsimbazaza, Madagascar, 1–III–1948 (MNHN); 1♂ ex *Miniopterus*, Grotte d'Andalambezo, Madagascar (MNHN); 1♂4♀♀ ex *M. scotinus*, Madagascar (MNHN 1912–44, *Calcarmyobia* sp. nr. *kenyaensis* in Uchikawa, 1982).

Calcarmyobia steatosetae steatosetae sp. n., ssp. n.

MALE (Figs 1, 2, 3 & 4). Seta *vi* thickened posteriorly, rather short and not reaching to genital shield. Seta d_1 distinctly thinner than d_2. Genital shield bearing *gp*, which is modified into a process. Modified claw on leg II only slightly inferior in thickness and length to normal one; modified seta on genu II as in Fig. 4; a thickened seta ventrally on tarsus II. Penis curved.

Measurements in μm for holotype and a paratype. Body (=gnathosoma+idiosoma) 460–460 long by 195–200 wide. Seta *ve* 138–142 long; *vi* 120–117 long; *sc e* ?–150 long; *sc i* 85–85 long; d_1 33–35 long; d_2 35–40 long; d_3 43–43 long; l_1 145–142 long; l_3 63–65 long. Genital shield 55–52 long (excluding *gp*); distance between *ga, ga–ga*, 37–35. Modified seta on genu II 20–21 long. Penis *ca.* 150–153 long.

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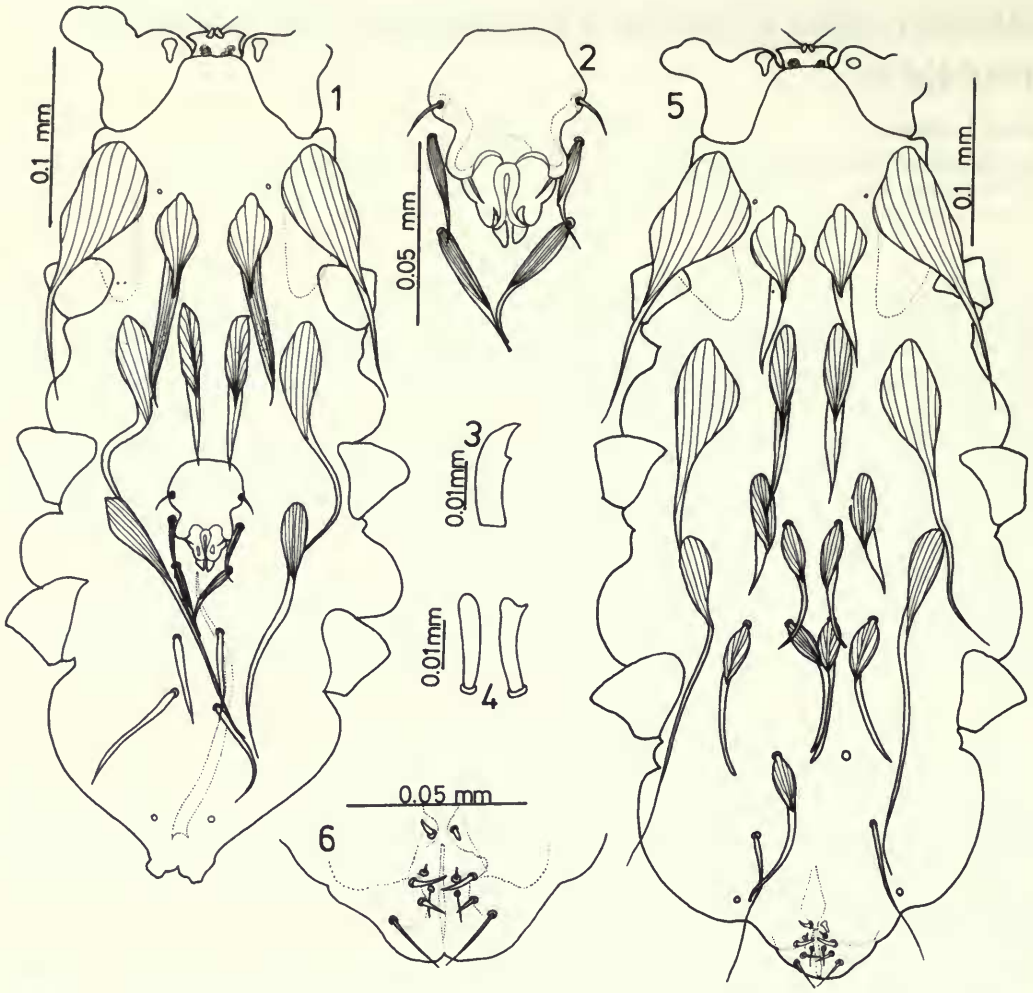


Figs 1–6 *Calcarmyobia steatosetae steatosetae* sp. n., ssp. n.: holotype male (1); genital shield of male (2); modified claw on leg II of male (3); modified seta on genu II of male (4); allotype female (5); genito-anal setae of female (6).

FEMALE (Figs 5 & 6). Seta d_1 distinctly shorter than d_2; striated basal part of d_2 longer than tail; d_3 and l_2 originating from almost the same level. Anal seta *ai* clavate, smaller than that of *C. comoresensis;* g_7 stout and rather short; g_5 prominent.

Measurements in μm for allotype and, in parentheses, for 2 paratypes. Body 540 (570–550) long by 250 (?–250) wide. Seta *ve* 170(163–160); *vi* 102 (108–100); *sc e* 183 (198–195); *sc i* 108(110–110); d_1 70(63–66); d_2 80(75–72); d_3 90(90–85); d_4 95(85–88); l_1 198(193–*ca.* 200); l_2 90(85–83); d_1–d_1 60(60–62); d_2–d_2 30(30–25); d_3–d_3 23(20–22); l_2–l_2 72(78–72); d_4–d_4 40(35–30).

MATERIAL EXAMINED. Holotype male (1984.6.12.134) and allotype female (1984.6.12.135) ex *Miniopterus manavi,* Bealanana, N. Madagascar (BMNH 25.12.9.18–21); paratype male, 2 paratype females and 1♀ ex *Miniopterus*, Montague d'Ambre, Madagascar (MNHN; M–82 and others by Maeda); 1♂2♀♀ (1984.6.12.136–138) ex *M. manavi,* Nanavimenu, Madagascar (BMNH 77.2.19.1–5, 7); 1♀ (1984.6.12.139) ex *M. manavi,* Vinanitelo, Madagascar, 30–V–1896 (BMNH 97.9.1.40).

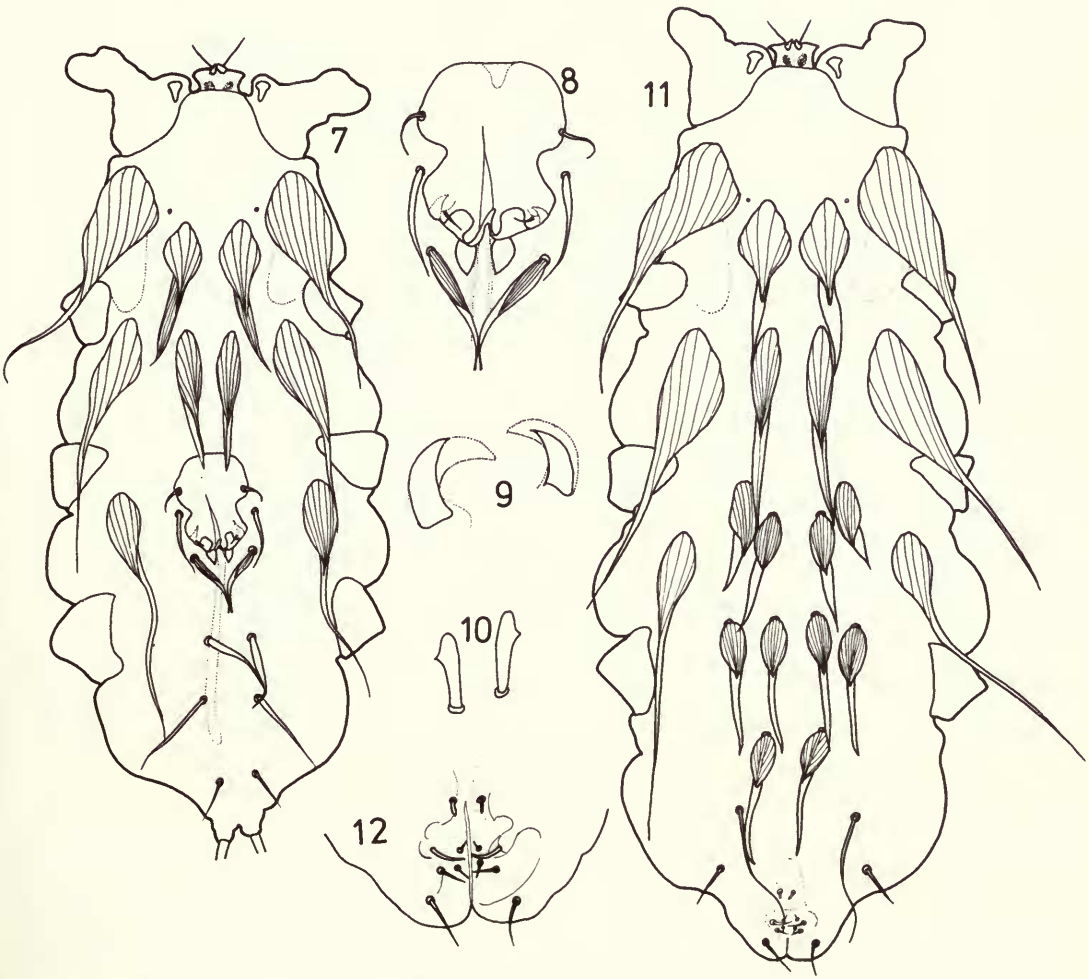
REMARKS. *Calcarmyobia steatosetae steatosetae* sp. n., ssp. n. resembles *C. comoresensis* Uchikawa, but is distinct in having seta *vi* short not reaching to the genital shield in the male. The

posterior formation of the male genital shield is also quite different in the new species and in *C. comoresensis,* that is, *gp* is short and swollen in the former, while it is missing in the latter. The females of *C. steatosetae steatosetae* and *C. comoresensis* are barely separable from each other by the nature of the anal seta *ai* and genital seta g_7. The seta *ai* is distinctly smaller on *C. steatosetae steatosetae* than on *C. comorensis,* and g_7 of *C. steatosetae steatosetae* is slightly thicker and shorter than that of *C. comoresensis.*

The present new mite is recorded only from Madagascar, and its host is *M. manavi* subject to confirmation.

Calcarmyobia steatosetae rectipenis ssp. n.

MALE (Figs 7, 8, 9 & 10). Seta *vi* very short; its tail distinctly shorter that striated basal part. Genital shield deformed, but bearing swollen *gp.* Modified claw on leg II distinctly smaller than normal one, and probably simple in shape; modified seta on genu II rather long. Penis almost straight and short.



Figs 7–12 *Calcarmyobia steatosetae rectipenis* ssp. n.: holotype male (7); genital shield of male (8); modified claw on leg II of male (9); modified seta on genu II of male (10); allotype female (11); genito-anal setae of female (12).

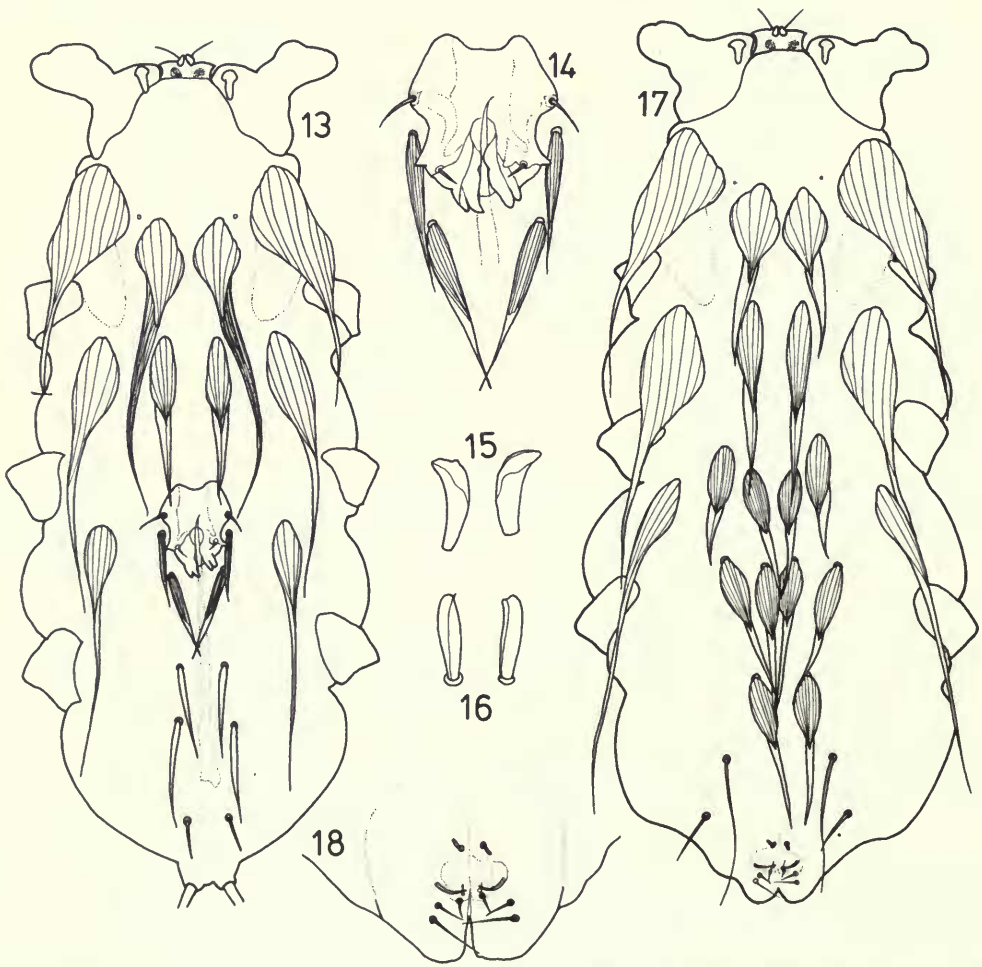
Measurements in μm for holotype. Body 410 long by 180 wide. Seta *vi* 84(striated part 53); *sc e* 125; *sc i* 79; d_1 *ca.* 35; d_2 38; d_3 *ca.* 42; l_1 *ca.* 133; l_3 53. Genital shield 52 long (excluding *gp*); *ga–ga* 35. Modified seta on genu II 23. Penis 133.

FEMALE (Figs 11 & 12). Setae d_1 and d_2 subequal in length; setae g_7 slenderer and g_5 and *ai* weaker than corresponding setae of nominate form. Other structures as in nominate form.

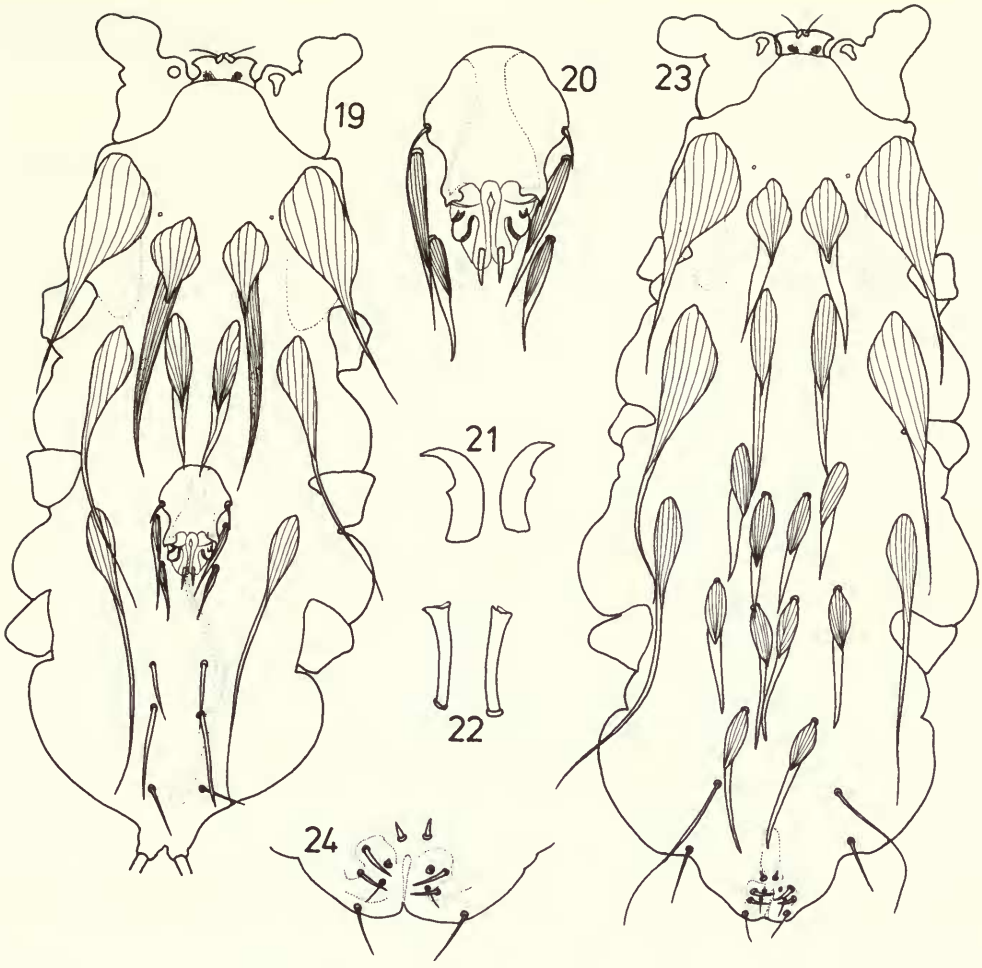
Measurements in μm for allotype. Body 540 long by 230 wide. Seta *ve ca.* 160; *vi* 100; *sc e* 163; *sc i* 115, d_1 65; d_2 66; d_3 80; d_4 82; l_1 *ca.* 185; l_2 75; d_1–d_1 58; d_2–d_2 27; d_3–d_3 23; l_2–l_2 70; l_4–l_4 30.

MATERIAL EXAMINED. Holotype male and allotype female ex *Miniopterus manavi,* Andrandoka (found in cave), Madagascar, 7–XII–1951 (USNM 294524–9).

REMARKS. Although the genital shield of the male, one of the most important properties for distinguishing the species of *Calcarmyobia,* is not clearly observed, the structure of the shield is essentially the same to that of *C. steatosetae steatosetae*. The measurement of setae *vi*, form of the modified claw on leg II and of the modified seta on genu II, are unique in the male of the present



Figs 13–18 *Calcarmyobia exserta* sp. n.: holotype male (13); genital shield of male (14); modified claw on leg II of male (15); modified seta on genu II of male (16); allotype female (17); genito-anal setae of female (18).



Figs 19–24 *Calcarmyobia minoris* sp. n.: holotype male (19); genital shield of male (20); modified claw on leg II of male (21); modified seta on genu II of male (22); allotype female (23); genito-anal setae of female (24).

form. Further, the relative length of d_1 and d_2 and the nature of *ai* and g_7 of the female are slightly different in both the present subspecies and the nominate form.

The host bats are again identified as *M. manavi,* but it is necessary to reconfirm their identity.

Calcarmyobia exserta sp. n.

MALE (Figs 13, 14, 15 & 16). Seta *vi* long, fully reaching to *ga*; d_1 and d_2 and similar; d_3 rather slenderer. Genital shield protruding laterally at level of *gm*. Modified claw on leg II as in Fig. 16; its lateral view not obtained. Modified seta on genu II short. Penis straight.

Measurements in μm for holotype. Body 440 long by 190 wide. Seta *ve* 135, *vi ca.* 165; *sc e* 150; *sc i* 85; d_1 38; d_2 50; d_3 47; l_1 150; l_3 58. Genital shield *ca.* 53 long; *ga–ga* 35. Modified seta on genu II 18. Penis 148.

FEMALE (Figs 17 & 18). Seta d_1 distinctly shorter than d_2; striated basal part of d_1 long (45–50 μm) and slender; striated basal part of d_2–d_4 and l_2 also slender; d_3 and l_2 originating from almost the same level. Anal seta *ai* clavate but not so prominent; g_5 weak.

Measurements in μm for allotype and 3 paratypes. Body 510 (530–550) long by 220(240–245) wide. Seta *ve* 158(155–160); *vi* 108 (95–105); *sc e* 188(182–188); *sc i* 118(120–120); d_1 72(67–78); d_2 80(75–83); d_3 88(88–95); d_4 90(85–90); l_1 >210(205–205); l_2 85(80–83); d_1–d_1 55(48–58); d_2–d_2 24(20–28); d_3–d_3 18(18–20); l_2–l_2 64(68–70); d_4–d_4 30(30–30).

MATERIAL EXAMINED. Holotype male, allotype female and 3 paratype females ex *Miniopterus*, Namoroka, Madagascar, IX-1952 (MNHN); 1♀ ex *Miniopterus*, Andalambezo, Madagascar, VII–1956 (MNHN); 1♀ ex *Miniopterus*, Ambohimirija, Madagascar, IX-1952 (MNHN).

REMARKS. The male of *Calcarmyobia exserta* sp. n. is distinct in having the genital shield with the lateral protuberance level with *gm*. Among the known species of the genus *Calcarmyobia, C. kenyaensis* Uchikawa also bears a similar protruberance. This species is, however, different from the present new species in having a pair of normal or unmodified claws on leg II.

The female of *C. exserta* is very close to those of the other two species, *C. comoresensis* and *C. steatosetae steatosetae*, distributed in Madagascar. *C. comoresensis* bearing strong *ai* is easily distinguished from the other two species; *C. steatosetae steatosetae* and the present new species are separable from each other by the combination of the nature of the setae d_1 and g_5. The striated basal part of d_1 is longer and slenderer and g_5 is finer in the former than in the latter.

Calcarmyobia minoris sp. n.

MALE (Figs 19, 20, 21 & 22). Seta *vi* rounded anteriorly, reaching to genital shield; d_1 distinctly longer and thicker than d_2; d_2 and d_3 situated widely apart from each other. Genital shield bearing fine and long *gm* and thickened and simple *gp*. Modified claw on leg II as in Fig. 21; modified seta on genu II long.

Measurements in μm for holotype and, in parentheses, for 2 paratypes. Body 430(470–480) long by 190(200–210) wide. Seta *ve ca.* 140(155–143); *vi* 150(150–155); *sc e* 170(170–170); *sc i* 82(83–84); $d_1$45(43–45); d_2 35(35–30); d_3 30(40–40); d_2–d_3 60(66–60); l_1 160(160–?). Genital shield 58(62–62) long; *ga–ga* 37(42–40). Modified seta on genu II 23(24–25). Penis *ca.* 150(150–145).

FEMALE (Figs 23 & 24). Seta d_1 almost the same in length to d_2; striated basal part and tail of d_1 subequal in length; d_3 originating from slightly or distinctly posterior to basal level of l_2; striated basal part of d_1–d_4 and l_2 rather slender and less than 15 μm. Anal seta *ai* weakly clavate; g_7 slightly thicker than g_5.

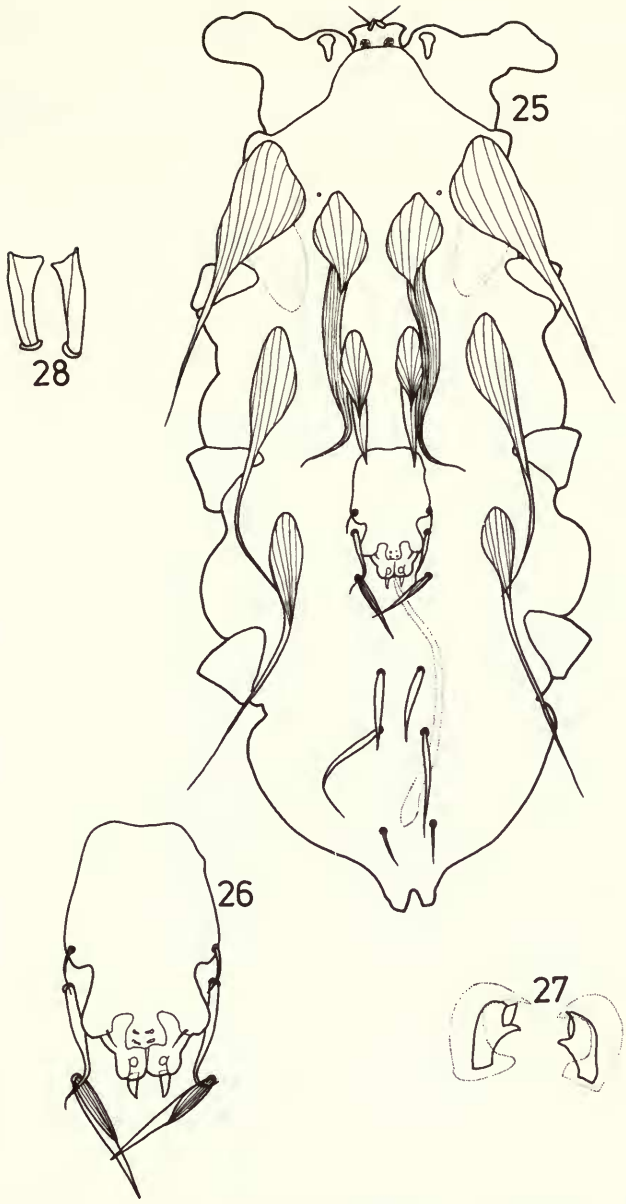
Measurements in μm for allotype and 2 paratypes. Body 525(540–550) long by 230(250–245) wide. Seta *ve* 163(170–163); *vi* 105(103–95); *sc e ca.* 200(?–195); *sc i* 110(115–108); d_1 73(78–75); d_2 70(78–80); d_3 80(88–88); d_4 78(83–90); l_1 213(220–225); l_2 75(78–88); d_1–d_1 57(60–55); d_2–d_2 24(23–24); d_3–d_3 20(20–22); l_2–l_2 65(65–62); d_4–d_4 38(33–31).

MATERIAL EXAMINED. Holotype male and allotype female ex *Miniopterus minor minor*, Similani Cave, 16 km S. of Mombasa, Coast Province, Kenya, 29–IX–1975 (AMNH 237341–3); a pair of male (1984.6.12.140) and female (1984.6.12.141) paratypes, 4♂♂(1984.6.12.142–145) and 4♀♀ (1984.6.12.146–148) ex *Miniopterus* sp., Shimoni, Mombasa, Kenya (BMNH 11.12.10.14–21); a pair of male (1984.6.12.149) and female (1984.6.12.150) paratypes, 2♂♂ (1984.6.12.151–152) and 2♀♀ (1984.6.12.153–154) ex *M. minor*, Amboni Caves, Tanga, Tanzania (BMNH 52.1333–63).

REMARKS. The male of *C. minoris* sp. n. is distinct in having d_1, which is distinctly thicker and longer than d_2, and the long and slender modified seta on genu II. The structure of the genital shield of the new species is almost the same as that of *C. congoensis* sspp., yet the length of the shield and the nature of *gp* are slightly different in both species.

The female of *C. minoris* is characterized by dorsal seta d_3 originating from the posterior level of the base of l_1.

The host bat is thought to be *Miniopterus minor*, and the distribution of the mite is so far restricted to the eastern coast of the central part of Africa.



Figs 25–28 *Calcarmyobia producta* sp. n.: holotype male (25); genital shield of male (26); modified claw on leg II of male (27); modified seta on genu II of male (28).

Calcarmyobia producta sp. n.

MALE. (Figs 25, 26, 27 & 28). Seta *vi* reaching to genital shield; striated basal part of *sc i* swollen, widest at middle; d_1 distinctly thinner than d_2. Genital shield long, especially with elongate anterior part; *gp* weakly inflated. One claw on leg II shorter than the other and strongly modified; modified seta on genu II thick and rather long. Penis curved.

Measurements in μm for holotype and, in parentheses, for 2 paratypes. Body 470(480–470) long by 210(205–210) wide. Seta *ve* ?(162–145); *vi* ?(160–153); *sc e* 160(?–160); *sc i* 78(75–75); d_1 43(38–38); d_2

45(35–39); d_3 51(43–47); l_1 ?(167–170); l_2 ?(60–75). Genital shield 70(68–69); *ga–ga* 40(40–40). Modified seta on genu II 22(20–22). Penis *ca.* 160(1558-*ca.* 150).

FEMALE. A female specimen was taken together with the holotype of the present new species from the type specimen of *Miniopterus schreibersi pulcher*. This specimen was not separable from the female of the atypical form of *C. congoensis*, and was not definitely identified as the partner female of *C. producta* sp. n.

MATERIAL EXAMINED. Holotype male (1984.6.12.155) (and a female 1984.6.12.156) ex *Miniopterus schreibersi pulcher*, Kurdistan, N. Iraq, 6–VIII–1954 (BMNH 67.1230, type); 2 paratype males ex *Miniopterus* (labelled *inflatus)*, N. Chyulu Hills, Kenya, 7–V–1979 (SMF 57588).

REMARKS. The male of *C. producta* sp. n. is distinct in having the genital shield with elongate anterior part. The hosts of the new mite are listed above, but it is not clear whether they are true hosts or not.

A list of the hosts and localities of all the mites dealt with in the present paper is given in Table 1.

Table 1 List of hosts and localities of the mites of the genus *Calcarmyobia* Radford from the Ethiopian region dealt with in the present paper

Mite species	BMNH Accession Number	Host species	Locality	Code No.	Host Accession Number
C. comoresensis		*Miniopterus*	Madagascar	4	MNNH ——
		Miniopterus	Madagascar	6	MNHN ——
	1984.6.12.128–129	*M. majori*	Madagascar	180	BMNH 0.5.5.48
	1984.6.12.130	*M. majori*	Madagascar	181	BMNH 32.7.19.1–2
	1984.6.12.131	*M. manavi*	Madagascar	157	BMNH 97.9.1.37**
		M. scotinus	Madagascar	—	MNHN 1912–44
	1984.6.12.132–133	*M. scotinus*	Madagascar	56	BMNH 97.9.1.41–3
*C. steatosetae steatosetae**		*Miniopterus*	Madagascar	8	MNHN ——
	1984.6.12.134–135	*M. manavi*	Madagascar	179	BMNH 25.12.9.18–19
	1984.6.12.136–138	*M. manavi*	Madagascar	177	BMNH 77.2.19.1–5,7
	1984.6.12.139	*M. manavi*	Madagascar	178	BMNH 97.9.1.40
*C. steatosetae rectipenis**		*M. manavi*	Madagascar	61	USNM 294524–9
*C. exserta**		*Miniopterus*	Madagascar	11	MNHN ——
		Miniopterus	Madagascar	9	MNHN ——
		Miniopterus	Madagascar	10	MNHN ——
*C. minioris**	1984.6.12.140–148	*Miniopterus* sp.	Mombasa, Kenya	30	BMNH 11.12.10.14–21
		M. minor	Near Mombasa, Kenya	14	AMNH 237341–3
	1984.6.12.149–154	*M. minor*	Tanga, Tanzania	74	BMNH 52.1333–63
*C. producta**	1984.6.12.155 (–156)	*M. schreibersi pulcher*	N. Iraq	144	BMNH 67.1230**
		M. inflatus?	Kenya	43	SMF 57588

*New taxon, **Type specimen.

Discussion

The Ethiopian region mites, *Calcarmyobia rhinolophia* (Radford), the generic type, *C. congoensis* Uchikawa and *C. kenyaensis* Uchikawa, were described from continental Africa, and *C. comoresensis* Uchikawa from the Comores Islands (Uchikawa, 1982). All these species were obtained again in the present study as recorded in the previous paper (Uchikawa, 1985*b*), and 5 new

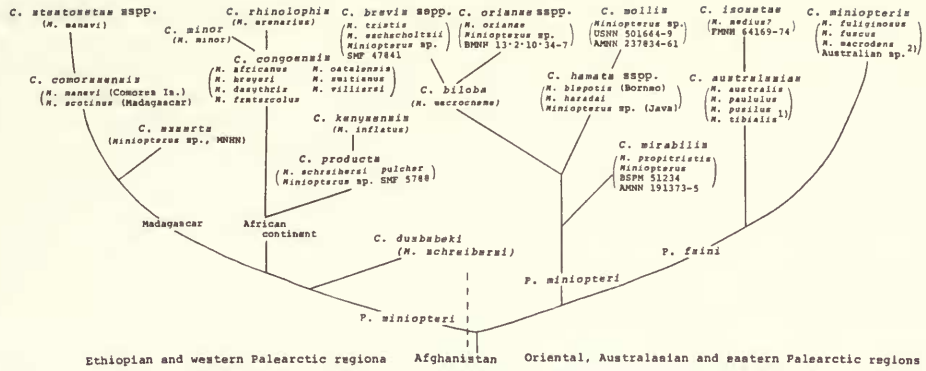


Fig. 29 Phylogenetic relationship among the mites of the genus *Calcarmyobia* parasitic on *Miniopterus* suggested by the formation of their male genital shields. Hosts of the mites are in parentheses. 1) Real *M. tibialis* is expected to harbour *P. faini*, 2) Species dealt with as *M. schreibersi* in Womersley (1941) and Fain & Lukoschus (1979).

species or subspecies were further added to the fauna in the present paper. Thus, the mites of the genus *Calcarmyobia* from the Ethiopian region come up at least to 9 species or subspecies. It is remarkable that no mite among the above 9 taxa occurs in both the continent and Madagascar. This might suggest that the bats of the genus *Miniopterus,* the specific hosts of *Calcarmyobia,* of both the subregions have become isolated from one another for a long time.

All the Ethiopian species of the mites, as well as *C. dusbabeki* Uchikawa distributed in the western Palearctic region, are thought to be closer to one another than to any of the mites from the Oriental, Australian and eastern Palearctic regions in having in common the male genital shields of a particular type which bears the genital seta *gm*. It should be noted that the shields of all the Oriental, Australasian and eastern Palearctic species lack the seta and bear the costal formation in place of the seta. As the genitalia of the mites are regarded as being conservative in evolution, the species with one type of genital shield are thought to be phylogenetically different from those with another type of shield. Thus, the mites from the Ethiopian and western Palearctic regions comprise a phylogenetic group that is separable from the other group consisting of the Oriental, Australasian and eastern Palaearctic species. This might be also the case for their host *Miniopterus*.

The distribution pattern of the mites of the genus *Pteracarus,* a very primitive myobiid genus parasitic on Vespertilionidae and their relatives, offers somewhat different information on their hosts. Only the 2 species, *P. miniopteri* Uchikawa and *P. faini* Uchikawa, have so far been known to occur on *Miniopterus*. It is proved that *P. miniopteri* is found on many kinds of the bats in almost the whole range of *Miniopterus* excluding the eastern Palearctic region, while *P. faini* is distributed on a few species of the bats in the Oriental, Australasian and eastern Palearctic regions. Accordingly, the host bats of these mites are regarded as being diphylogenetic, a host group for *P. miniopteri* and the other for *P. faini* (Uchikawa, 1985*a*). Contrary to the above deduction for mites of the genus *Calcarmyobia*, the host *Miniopterus* of *P. miniopteri* from all the Ethiopian, western Palearctic, Oriental and Australasian regions are regarded as being phylogenetically the same to one another, while the hosts of *P. faini* comprise the other group in the Oriental, Australasian and eastern Palearctic regions. These contradictory deductions might be synthesized as follows: The bats of the genus *Miniopterus* had been essentially monophylogenetic in origin, since such a conservative parasite as *P. miniopteri* is parasitic on so many kinds of the bats in almost the whole range of *Miniopterus*. Also, the bats of the Ethiopian and western Palearctic regions have been isolated for so long from those of the Oriental, Australasian and eastern Palearctic regions that the bats from either geographical range have their respective type of acarine parasites of the genus *Calcarmyobia*. As the host bats of *P. miniopteri* and *P. faini* harbour the same type of *Calcarmyobia* in the Oriental, Australasian and eastern Palearctic regions,

the host group of *P. faini* is thought to be derived from the other group in a limited range in relatively recent times.

Miniopterus schreibersi, the generic type, had long been believed to occur in almost the whole range of *Miniopterus,* and thus many specimens of the bats from the Ethiopian, Oriental, Australasian and eastern Palearctic regions were identified as *M. schreibersi* or *M. schreibersi* sspp. in the collections of the big museums in Europe and the United States. *M. schreibersi* distributed in Romania, the type locality of the bat, and in other European countries is the host of *C. dusabeki.* This mite prevails in the western Palearctic region east to Afghanistan, and there meets *C. miniopteris* Womersley (Uchikawa, 1985*b*). In the other regions, different mites of the genus *Calcarmyobia* are found on the bats *M. schreibersi* or *M. schreibersi* sspp. As the mites of the genus are not synhospitalic, the bats that harbour different species of the mites could not be conspecific. Accordingly, it is reasonable to regard *M. schreibersi* as being distributed only in the range of *C. dusbabeki*, that is, the western Palearctic region (Uchikawa, 1985*b*). The bat of the genus *Miniopterus* distributed in the eastern Palearctic region from Afghanistan to the Far East, which harbours *C. miniopteris*, had long been considered as a subspecies of *M. schreibersi.* Although bats distributed in the same biogeographic range are ready to be regarded as being conspecific, the *Miniopterus* bats distributed in the western and eastern Palearctic regions are distinctly different from each other sufficiently beyond the subspecies level with a boundary around Afghanistan as elucidated above adopting acarine parasites as indicators. This might not be an exceptional case only for *Miniopterus.* Some bats of the other genera distributed in the different parts of the Palearctic region might have the same distribution pattern as that of *Miniopterus.*

The data for the mites of the genus *Calcarmyobia* are still fragmentary, and only the type specimens are known in some cases. On these records, it is still possible to postulate that the mites of this genus have rather limited distributional ranges. Even the 3 species of mites with the widest ranges do not prevail on the whole range of *Miniopterus,* and, in the Oriental region, closely related mites are often found on bats from islands near to each other (Uchikawa, 1985*c*). As different mites infest respective bats, this limited distribution pattern of the mites suggests the same pattern of their hosts. Because of their supposed movability, the Chiroptera have been excluded as a rule in the consideration in zoogeography. The distribution of some bats should, however, be regarded as being definite and limited from the data on the acarine parasites.

Myobiid mites serve as indicators in the taxonomy or phylogeny of their hosts (Uchikawa & Harada, 1981). Adopting the male genital shield of mites of the genus *Calcarmyobia* as the criterion, a scheme suggesting phylogenetic relationship among the mites is proposed as in Fig. 29. The records of *Pteracarus* are also included in the figure. These data might show the relationship among the host bats of the mites, which are also recorded in parentheses. The taxonomy of bats of the genus *Miniopterus* is still far from satisfactory and some ambiguous and/or incorrect specific names of the bats might have been adopted in the figure. The above parasitological deduction on the relationship among *Miniopterus* is contradictory in some points to the proposals recently made upon the improved methods by such chiropterologists as Peterson (1981) and Maeda (1982). The most striking difference between parasitological and anatomical deductions by Peterson (1981) and Maeda (1982) is that the bats of the *tristis* group are quite differently dealt with in Fig. 29. This suggests that the parasitological data are indicative of some phylogenetic aspects of host animals still unnoticed or unaccustomed in the traditional study of the host themselves. Further studies of both the parasites and their hosts are necessary to interpret such a problem.

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